Open Automated Demand Response Communications in Demand Response for Wholesale Ancillary Services

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Demand Response Research Center

Presentation Overview

- **Objectives**

- **System Architecture**

- **Methodology**

- **Results**

- **Conclusion and Next Steps**

Participating Load Pilot Project

- Research Objectives:
  - Can OpenADR be used for ancillary services?
  - Are current DR strategies in C&I fast enough for fast DR?
  - Can the communication infrastructure over the Internet accommodate fast DR requirements: PL Resources have to meet non-spinning reserve requirements:
    - the resources have to deliver energy within 10-minutes,
    - be available for 2 hours, and
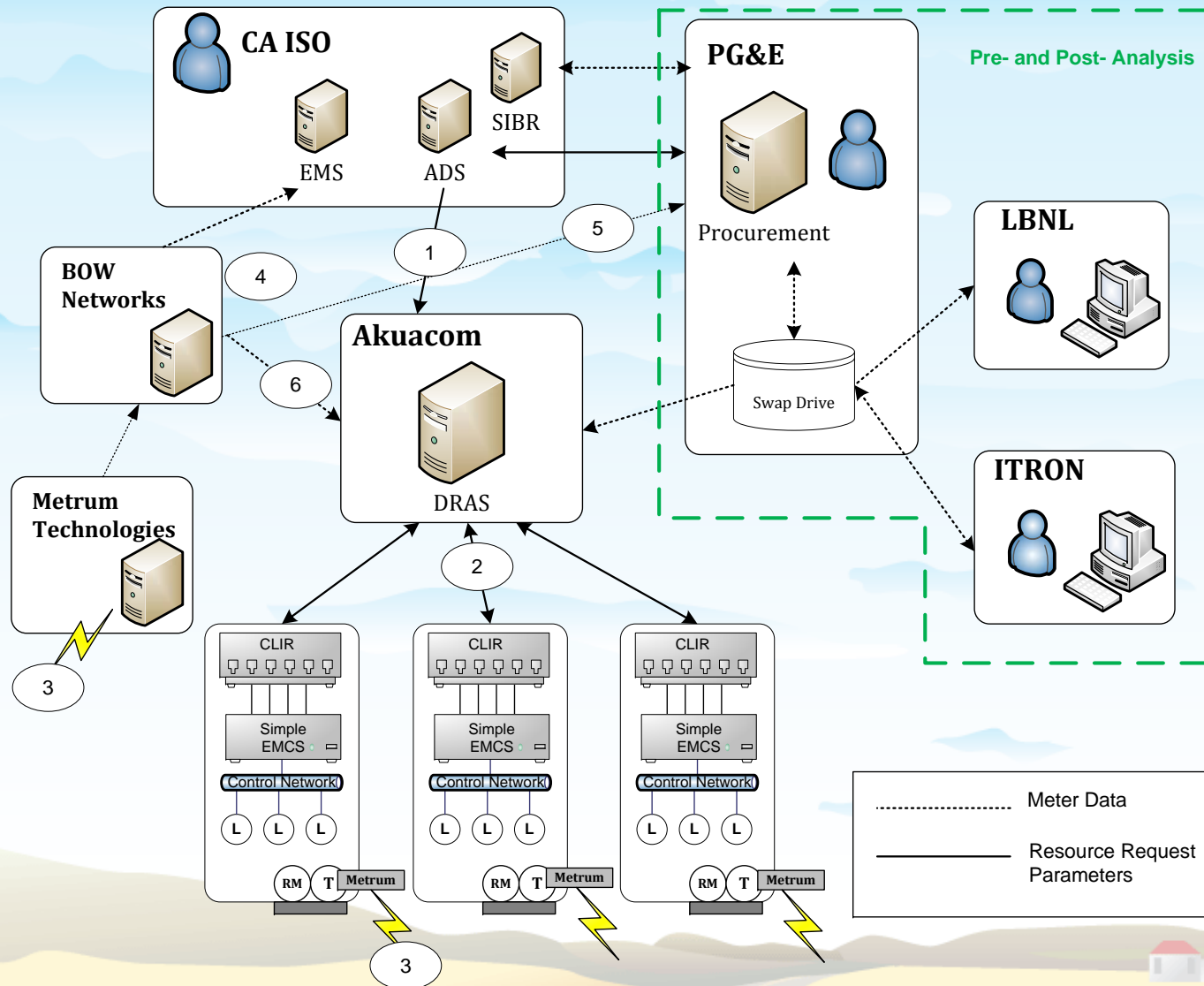   - provide real-time telemetry to the CAISO
- PLP Team:
  - PG&E
  - Itron
  - Akuacom
  - CAISO
  - Metrum Technologies
  - Bow Networks
  - LBNL

Participating Load Pilot (PLP) Architecture

Acronyms:

EMS – Energy Management System

ADS – Automatic Dispatch System

SIBR – Scheduling Infrastructure Business Rules

DRAS – DR Automation Server

CLIR – Client Logic with Integrated Relay

RM – Revenue Meter

T – Telemetry

http://newscenter.lbl.gov/feature-stories/2009/08/19/smart-grid-success/

Methodology

- *Site Selection:* Developing criteria that considers load variability, weather sensitivity and load statistical summaries

- *DR Strategies*: Each facility used their existing DR strategies. One facility test the use of feedback.

- *Ramp Rate Calculations*: (MW/min)

- *Data collection:* 15 min, 5 min and 4 sec. data

- *Demand Shed Calculations:* Forecasted loads are considered baseline.

- *Settlement Calculations:* (Actual Meter – DayAhead Schedule) X Real-Time Price

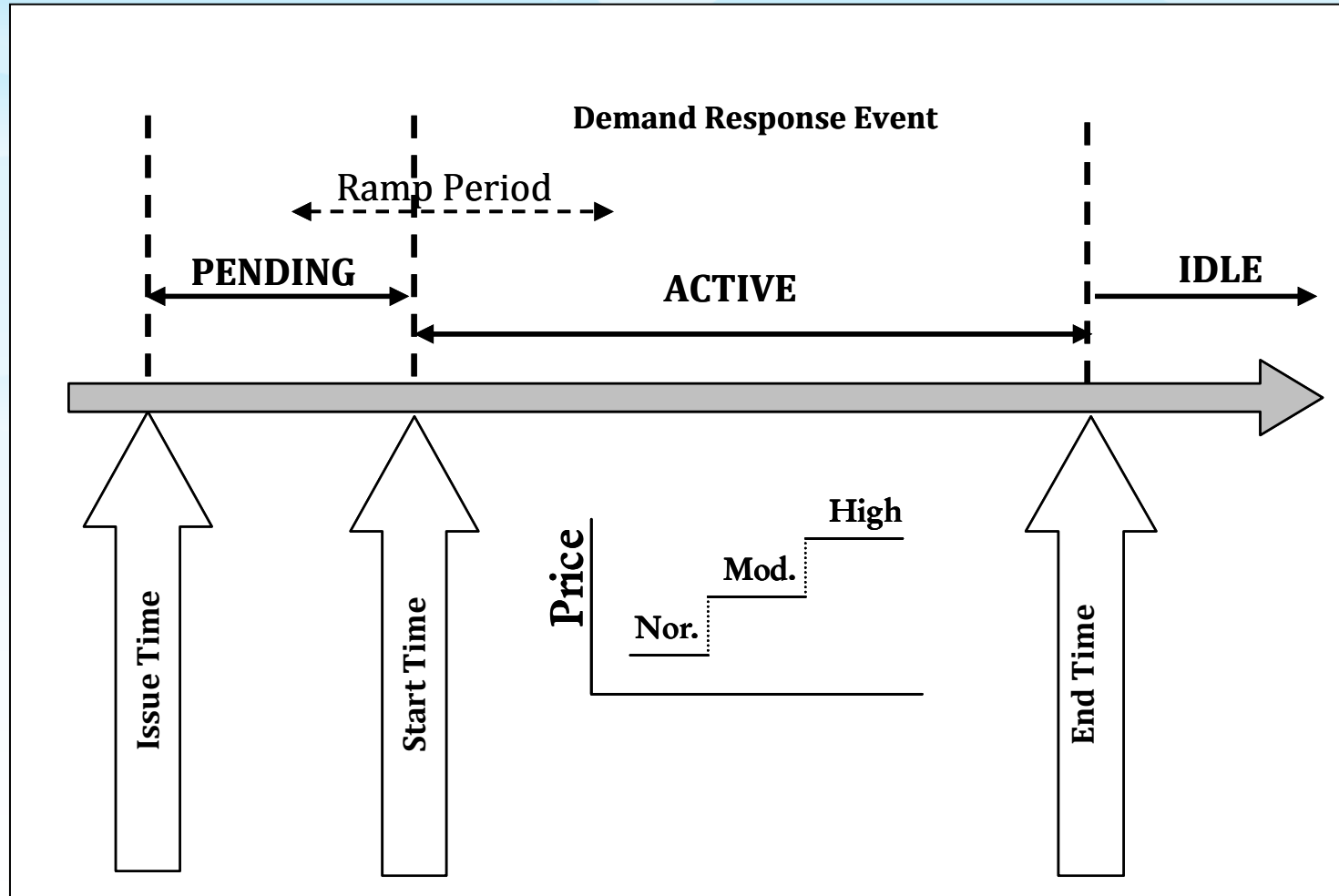- *Dispatch Signal Propagation*: Dispatch received in XML

DR Strategies

Site	DR Strategy	DR Period
IKEA EPA	Turning off 11 RTUs out of 43 and raising zone setpoints to 76 DegF	Noon to 6 pm
Contra Costa County	4 DegF Global Temperature Adjustment with 1 DegF increments	2 pm to 6 pm
Svenhards	Turn off Pan Washer	3 pm to 5 pm

# OpenADR Signals – Critical Peak Pricing (CPP)

OpenADR signals - PLP
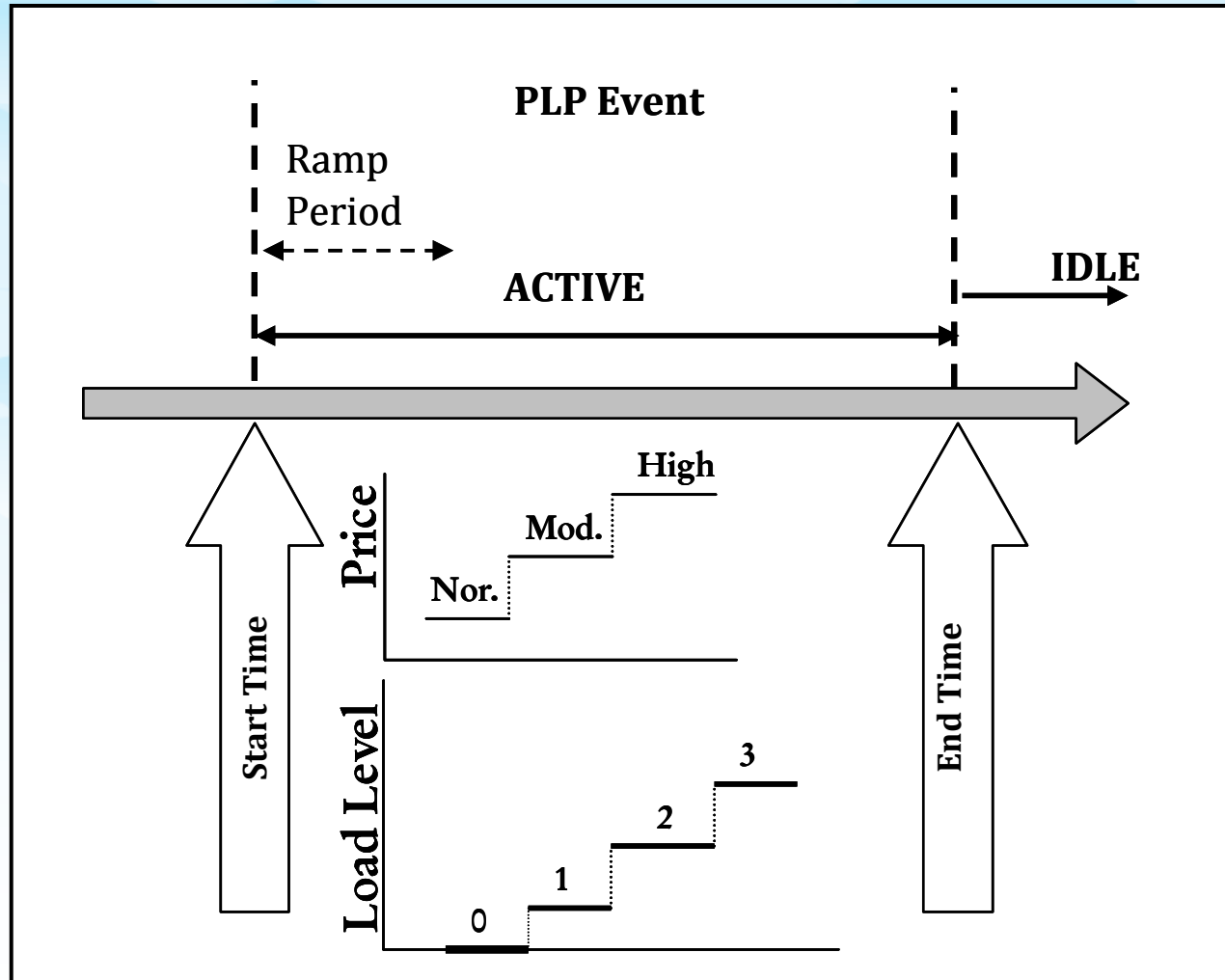
Test Dates and Sample Results

Site/Date	17-Jul	6-Aug	27-Aug	31-Aug	11-Sep	18-Sep	21-Sep	22-Sep
IKEA EPA	15:00 - 17:00				14:40 - 14:43	16:00 - 16:25, 16:35 - 16:50		
CCC	15:00 - 17:00	17:00 - 18:00		14:00 - 15:00	14:40 - 14:43	16:00 - 16:25, 16:35 - 16:50	14:00 - 16:30, 16:40 - 17:55	
Svenhards	15:00 - 17:00	15:00 - 16:00	15: 25 - 15:30			16:00 - 16:25, 16:35 - 16:50	16:30 - 16:40	16:55 - 17:00

Site	Date	vs. Actual Ramp Rate (MW/min)	Forecasted vs. Actual Average Load Reduction			
			HE 15:00	HE 16:00	HE 17:00	HE 18:00
Office	21-Sep	0.002/0.006	20/72	80/86	40/51	30/49
Bakery	18-Sep	0.012/0.012	-	-	120/143	-
Retail	18-Sep	0.001/0.01	-	-	50/20	-

Contra Costa County – Office Building
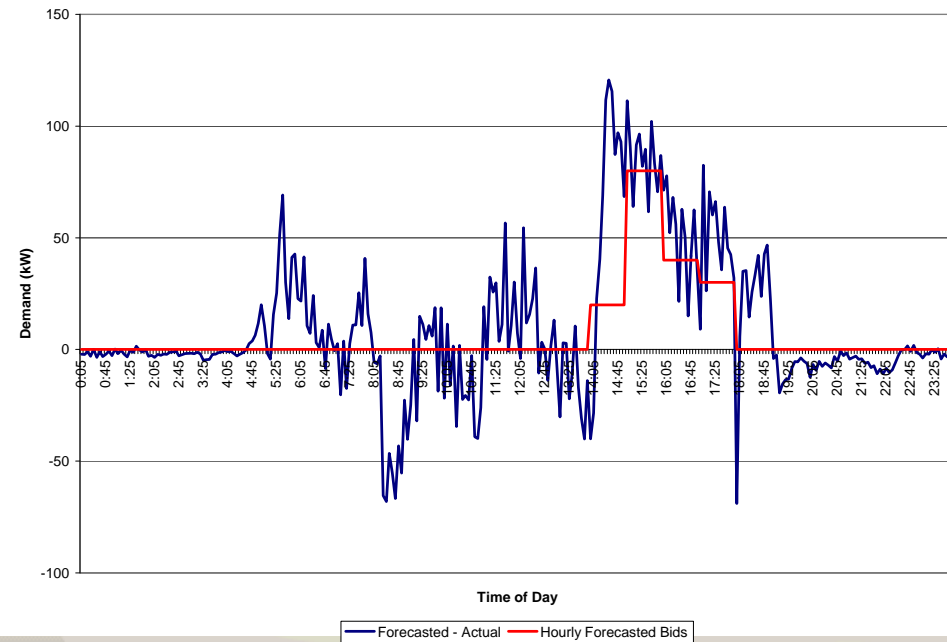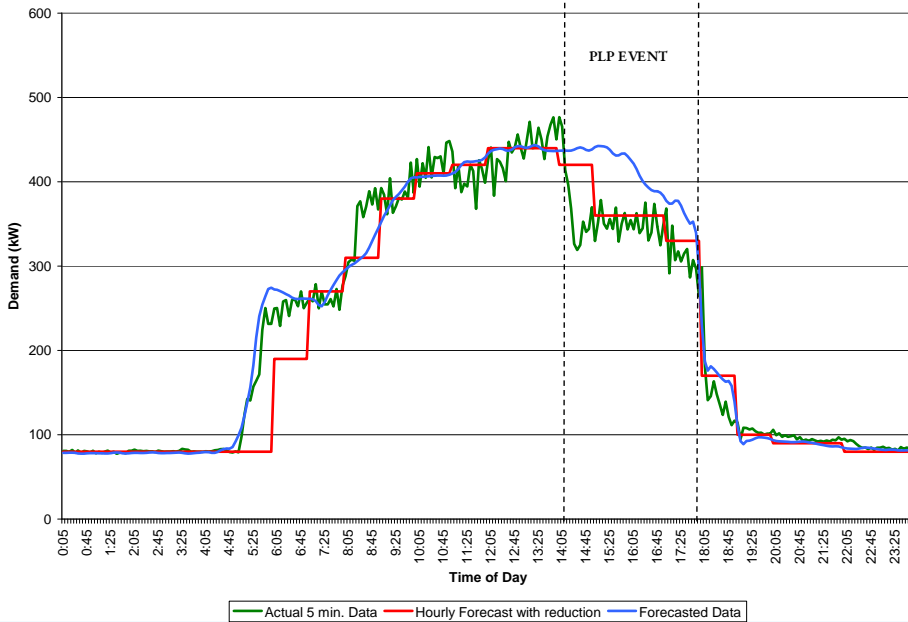
Conclusion

- HVAC as an end use and global temperature adjustment as a DR strategy meet the requirements for wholesale ancillary services.

- OpenADR specification is used to communicate wholesale DR events in an open and interoperable way.
  - Customer's transition from Auto-DR programs to PLP is seamless

- Internet can be used for fast DR to dispatch non-spinning ancillary services.

Next Steps

- *Need to resolve glitches….*
  - *Dispatch rules* were assumed to be sorted at the CAISO system and little intelligence was programmed into the DRAS in terms of program rules. DRAS can be used as a second check point for dispatch rules.
  - *Maximum duration of dispatch and number of events* for the PLP sites is not sufficient to test sustainability of sheds.
- *Forecasting loads* is a complex process and highly variable loads are extremely difficult to forecast. There is a need to develop better forecasting methods where load characteristics and changing in loads are better incorporated in the forecasting algorithms.
- *Cost of telemetry* for each site needs to be analyzed and scalability issues need to be explored.
- *Settlements* were not completed by the time this paper was written. Various value streams should be investigated.

Thank you!

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http://drrc.lbl.gov

Automation Goals and Definition

-Recent Research Goals

• Cost - Develop low-cost, automation infrastructure to improve DR capability in California

• Technology - Evaluate "readiness" of commercial buildings to receive signals

• Capability - Evaluate capability of control strategies for current and future buildings

-Auto-DR Definition - Fully automated signals for end-use control

• Signaling – Continuous, secure, reliable, 2-way comms; listen and acknowledge

• Industry Standards - Open, interoperable communications to integrate with both common EMCS and other end-use devices that can receive a relay or similar signals (such XML)

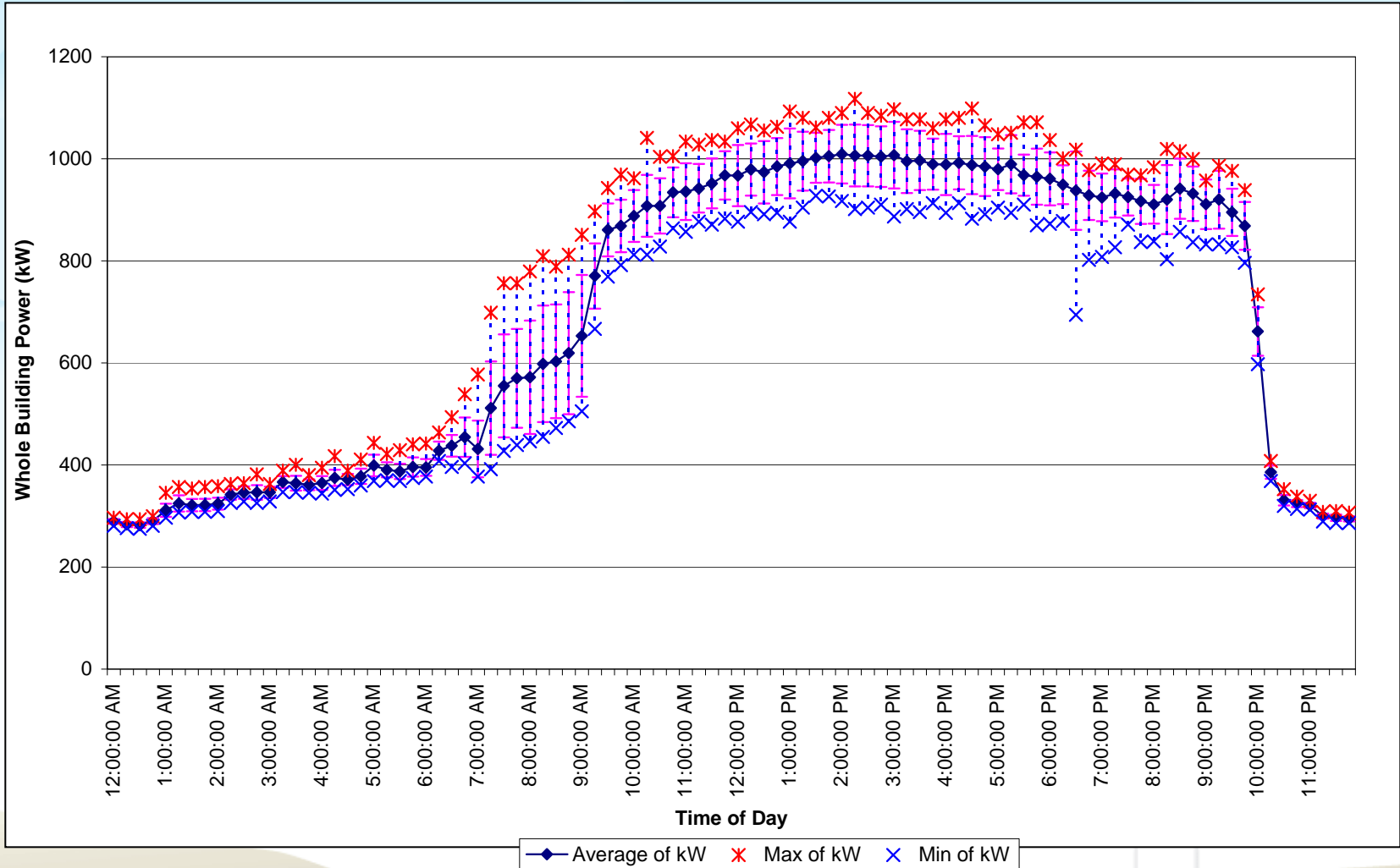• Timing of Notification - Day ahead and day of signals facilitate diverse strategies

Auto-DR Multi-Year Technology Development Summary

❑ **Develop Demand Response Automation Server (annually updated)**
❑ **Develop connection to Energy Management Control Systems (EMCS)**
❑ **Field Tests – Recruit sites/ 2 to 12 events per summer**
  - **2003** - 5 sites – Internet link to Energy Information Systems (EIS)
  - **2004** - 18 sites - linked to EIS and EMCS
  - **2005** - PG&E CPP collaboration
  - **2006** - PG&E, SDG&E, Planning with SCE
  - **2007** - PG&E and SCE
  - **2008** - PG&E and SCE
  - **2009** - Bonneville Power Administration/ Seattle City Light, Participating Load Pilot w/ PG&E
❑ **Evaluate with weather normalized baseline**
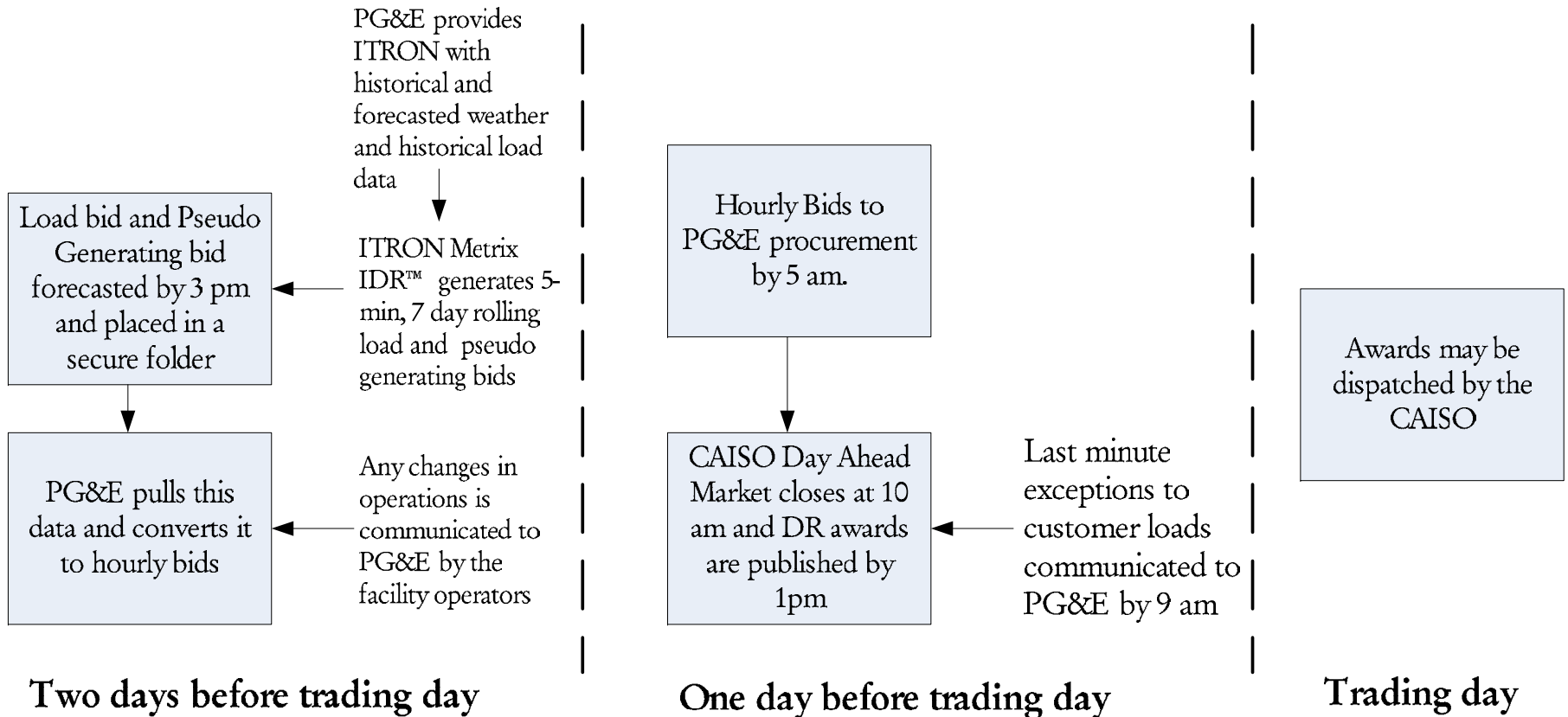❑ **Interview site after each event**

Year	# of Sites	DRAS	Site Communications	Utility
2003	5	Infotility	XML Gateway Software	None
2004	18	Infotility	XML - Internet Relay	None
2005	11	Akuacom	XML - Internet Relay	PG&E
2006	25	Akuacom	XML - CLIR	PG&E, SDG&E
2007-08	200+	Akuacom	XML - CLIR	Statewide

Site Selection

Schedule Submission Process

Grid-Interop

PG&E provides ITRON with historical and forecasted weather and historical load data

↓

ITRON Metrix IDR™ generates 5-min, 7 day rolling load and pseudo generating bids

Load bid and Pseudo Generating bid forecasted by 3 pm and placed in a secure folder

↓

PG&E pulls this data and converts it to hourly bids

Any changes in operations is communicated to PG&E by the facility operators

Hourly Bids to PG&E procurement by 5 am.

↓

CAISO Day Ahead Market closes at 10 am and DR awards are published by 1pm

Last minute exceptions to customer loads communicated to PG&E by 9 am

Awards may be dispatched by the CAISO

Two days before trading day   **One day before trading day**   **Trading day**

IKEA Hourly Loads and Actual 5 Minute Load Data
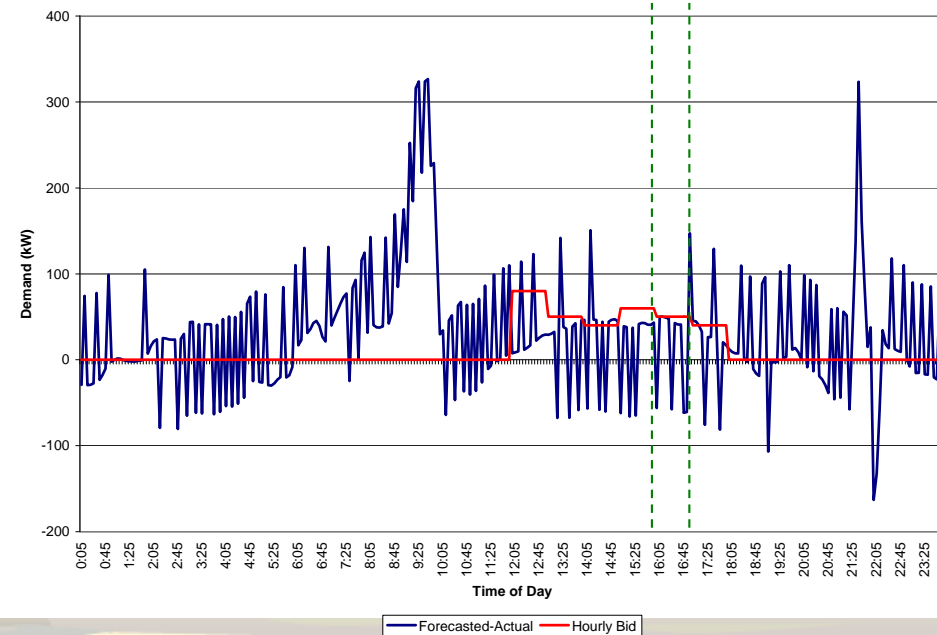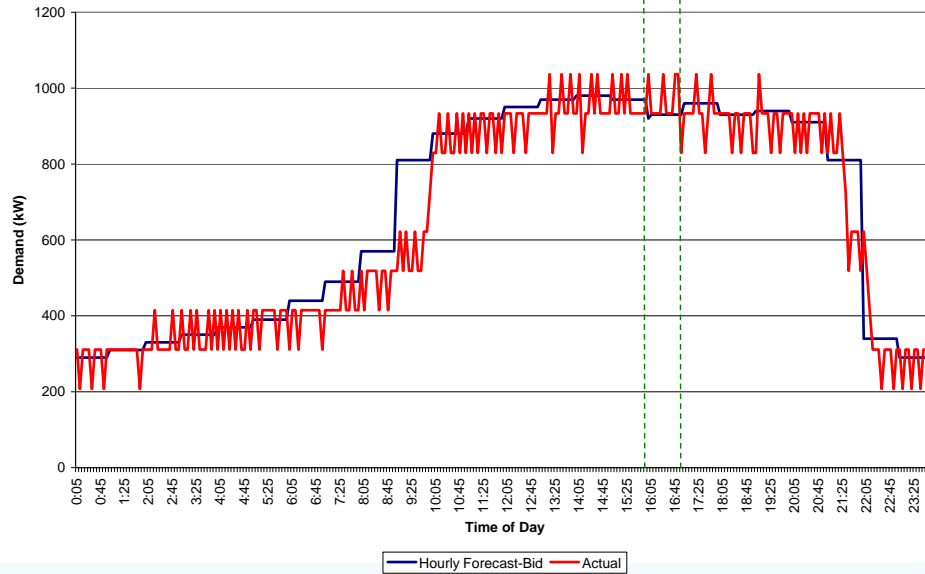
Svenhard's Swedish Bakery

Svenhard's 9/18/2009